WASTE SECTOR: WASTEWATER TO ELECTRICITY

♦ OREGON

Using Waste Methane to Power Hydrogen Fuel Cells

The Columbia Wastewater Treatment Plant in Portland, Oregon produces nearly one million cubic feet of methane each day as a natural by-product of anaerobic digestion at its facility. Seventy percent of the gas is recovered for use in the digesters, heating the facility, and for sale to a local manufacturer. The remaining 30%, until recently, had been flared. In an effort to productively use more of the surplus methane, the Bureau of Environmental Services investigated several recovery options, finally settling on a fuel cell power plant as the best solution.

Portland's fuel cell is a reliable power source, uses free fuel, and does not pollute the environment. The City of Portland funded the project with help from federal and state grants, as well as subsidies to boost clean renewable energy sources. The total cost of the fuel cell project is about $1.25 million, but with the help of grants and subsidies, the City of Portland's out-of-pocket costs are only about $750,000. The simple payback on the City's cost is 7.4 years with an internal rate of return of 6.3%.

Results:

Energy Savings	Cost Benefits	Greenhouse Gas Reductions
1.3 million kWh/yr	$88,000/yr (value of generated electricity)	134 MTCE*/yr

The electrical output of the City's fuel cell is estimated at 1.3 million kWh-enough electricity to power more than 100 homes for an entire year. The value of the generated electricity is $88,000 as renewable power, or $64,000 as "grid" supplied power from coal, hydro, and natural gas. Portland's fuel cell is virtually emission-free-releasing no particulates, no nitrogen, no sulfur, only 27 lbs NO_x and 38 lbs of CO per year. Net CO_2 reductions occur on a regional basis as Portland's fuel cell reduces the amount of power generated by fossil fuel-burning utilities in the Pacific Northwest. Based on the average mix of generation sources (hydro, coal, gas, nuclear) for Portland General Electric, the net annual CO_2 offsets are 492 metric tons (or 134 MTCE*) each year. In addition, the energy savings account for annual reductions of approximately 2.7 metric tons of NOx and 5.5 metric tons of SO_2 emissions.**

Through this fuel cell pilot, the Bureau of Environmental Services has the opportunity to recover more of the surplus methane, reduce air emissions, and generate electricity from a "free" renewable source.

Principal Actors:

The City of Portland's fuel cell power plant is operated by the Bureau of Environmental Services. Financial support comes from the City of Portland, OR Office of Energy, Portland General Electric, the U.S. Department of Defense, the Fuel Cell Climate Change Program and Oregon's Business Energy Tax Credit Program.

Additional Information:

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This case study is based on information provided by Dave Tooze, Portland Energy Office.
*Original data have been converted from short tons of CO_2 to Metric Tons of Carbon Equivalent (MTCE).
** The following conversion factors were applied to the original data: 1.77 MT NOx / GWh and 3.69 MT SO_2 / GWh, MT = metric tons.